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ABSTRACT

This paper first outlines the several problems encountered by architects in predicting user comprehension of designed environments, establishes the importance of the need to predict accurately, and suggests ways in which research can help improve prediction. Also discussed are the objectives and methodological problems associated with the four domains of research to be explored before an objective basis for preconstruction predictions can be established. These domains are (1) response formats, (2) media of presentation, (3) observers, and (4) environment. The previous research of the author in this area is then outlined, including the presentation of a 2-stage conceptual model of meaning (or comprehension) consisting of a representational stage followed by a responsive stage. The author describes one experimental study that compared the meanings attributed to environments by architects with those attributed by laymen, the findings of which revealed that the education of the architect accounted for the differences. Another experiment compared architects in different parts of the country and found similar, albeit less systematic, differences. The presentation concludes with a discussion of the current research of the author in which the adequacy of various media as representations of designed environments are compared. (Author)

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PREDICTING THE MEANING OF DESIGNED ENVIRONMENTS

Paper presented at the Western Psychological Association Meeting in San Francisco, April 24, 1971.

By Robert G. Hershberger, Ph.D., A.I.A.

THE ARCHITECT AS A PREDICTOR

The architect, amongst all men, is in most need of the knowledge which environmental psychologists can provide. It is the architect who must predict before construction how people will comprehend and use the buildings which he designs. This is not a simple task. Oh, to be sure it is rather easy to predict, we architects do it every day as we design our buildings. What is difficult, is to predict correctly and consistently.

Why is it that architects with long years of education and experience, and with all good intentions and purposes, design buildings which often are not well received by their clients, disdained by their users, and mocked by their critics? Why is it that the buildings which the architectural fraternity like most (architect's architecture) are often most disliked by the man on the street, or worse yet by their occupants? I maintain that most architects really do try to design buildings which will be admired and enjoyed by all who use them. Why then do we so often fail to accomplish our objectives?

Over the centuries, through personal observation, trial and error, and intuition, architects have developed a backlog of experience, understanding, if you will, about how buildings affect people... how buildings are perceived, understood, and used. In some cases our knowledge is definite and our predictions accurate. If we design an opening in a wall seven feet high by three feet wide, then place a wood panel of the same size in it, with hinges on one side and knob on the other, most people in our culture will

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recognize it as a door (an object which one opens to pass through) and will use it accordingly. But what if we design two such objects (doors) side by side along a wall or at the entrance to a building? Which one would most people select? The folklore of entrance design tells us that most people would choose the right door and, further, that they would turn to the right upon entering.¹ One wonders, however, if an Englishman accustomed to driving on the left side of the road would choose the left door and turn left once inside? Furthermore, what if the left door were painted red and the other left natural, or made wider than the other, or given an elaborate trim, or made of glass, or given an exquisite bronze knob? Which door would be chosen? Even folklore provides few answers. These then are very simple illustrations of the types of questions which face an architect daily for all aspects of design, and he must make accurate predictions as to what the occupants of his building will do and how they will feel, or face the prospect of the misuse of an bad feelings towards his building.

These are not trivial questions. Certainly they seldom approach the immediacy of the life or death considerations which face researchers studying the effects of environmental change in the aerospace program, nor have they received funding on even a remotely comparable basis. Indeed, it is probably for these reasons that so little systematic effort has been devoted to their solution. Yet collectively, the whole population considered, mistaken, inefficient, or unpleasant experiences in buildings account for tremendous loss of time and energy, and more important, in my mind, for loss of personal satisfaction with life, for feelings of insecurity,

¹ Fortunately, this is one area in which environmental psychologists have provided us with useful information. Gary Winkel and Robert Sasanoff, "Approach to an Objective Analysis of Behavior in Architectural Space". Unpublished, July 1, 1964.

hostility, and even rage. Occasionally they account for serious accidents or loss of life; witness the many people who have walked through floor to ceiling glass doors or windows, believing them to be open.

In fact, many of the prediction problems which architects face are of great importance. How does an anglo architect predict how minority groups will perceive, understand, and use public housing designed for them? Clearly, public housing for our urban black population is continuing testimony of the tremendous lapse of in-feeling or intuition that C.I.A.M. architects such as Gropius and Le Corbusier had when they proposed high towers set in green fields as a solution to the housing of our urban poor if, indeed, they actually thought it would work for poor blacks. But even if not, what about the many architects who have designed so much of this housing around the country? And the seriousness of the problem does not begin and end with public housing. What about predicting the comprehension and use of our designs for prisons, mental institutions, housing for the elderly, pre-school facilities, college dormitories...? Will the architect's knowledge and intuition ("anecdotal evidence and folklore wisdom" says Craik) of the occupants of those buildings allow him to make consistently accurate predictions about responses to what he designs. I think not. In the absence of better information, however, this is what the architect must try to do. Sometimes he succeeds. Quite often he fails. The architect needs help, and I am suggesting that the environmental psychologist is the person who can provide it.

RESEARCH NEEDS AND DIRECTIONS

In his article, "The Comprehension of the Everyday Physical Environment," Kenneth H. Craik outlined four domains of research which must be explored by environmental psychologists before an objective basis can be established for

pre-construction predictions about the comprehension of buildings by users.² Here, perhaps, is hope for improved prediction by architects.

1. Response Formats: What techniques or instruments should be used to discover how people comprehend their architectural environments? Is there one technique or instrument which will provide the designer with all of the information he needs? Will several approaches be necessary? How will information gained using one response format be structured relative to information gained using other formats? Clearly a great body of work must be done to test the reliability and validity of the procedures which might be used to obtain information about how people comprehend their environments.

2. Media of Presentation: How should architectural environments be presented to the persons whose comprehension we need to understand? Should direct or indirect media of presentation be used? Should the persons be sent to the buildings, or should the buildings be brought to them by means of photographs, films, models, or other such media? Should people be studied only in their everyday environments? Clearly to experience the actual environments would seem preferable, but what if the environments in question do not yet exist? Or, if such environments do exist, but are widely separated, could one afford to transport the respondents from one place to another? What if the researcher wishes to manipulate the environment to study the effects of variation in size, shape, and color? Clearly substitute media will sometimes be necessary. If they are used, how will they compare with direct experience or with other media? Can a mixed group of media be found which will serve as a reliable substitute for actual environments? A

²Kenneth H. Craik, "The Comprehension of the Everyday Physical Environment" Journal of the American Institute of Planners, Vol. 34, No. 1 (January, 1968), pp. 29-37.

considerable amount of work by environmental psychologists is needed to develop suitable methods for presenting architectural environments to various respondent groups.

3. Observers: Who should be studied? Should it be architects, clients, users, college students, critics? Will there be differences between males and females, children and adults, whites and blacks, poor and rich, and so on? What about users? Will top executives, junior executives, clerical help, and janitors comprehend the same architectural environments in the same way? If differences among groups are found, will they hold for other situations; could they be generalized so as to be useful for purposes of prediction? An infinite array of interesting and useful research could be done in this area to help the architect understand the perceptions, thoughts, and feelings of the people for whom he must design.

4. Environments: Which environments should be studied? Should the focus be on museums, convention centers, restaurants, and other interior or exterior places where "exploratory behavior" is paramount and immediate comprehension, therefore, of great importance? Or, should the focus be on housing, places of work, and institutions where "habitual behavior" is more common? Should the research attempt to develop descriptions of the various types of environments to allow comparison of their similarities and differences? Should evaluative assessments of the relative success, goodness, or aesthetic value of the environments be the primary concern? Undoubtedly both descriptive and evaluative assessments of many different building types will be required if the architect is ever to achieve an accurate basis for his preconstruction predictions.

For each of the above mentioned domains of research Dr. Craik points out some of the conceptual and practical implications of the several approaches

which might be taken and how it might be necessary methodologically to hold some areas constant while studying one or more of the others. Regarding preconstruction prediction he states:

"First, a fund of systematic empirical knowledge concerning stable relationships between descriptive characteristics of environmental displays and evaluative criterion indices would have to become available. Secondly, since at the preconstruction stage, only indirect media presentations are possible, the kind of research discussed earlier concerning improvement in the ability to make direct-media descriptive assessments upon the basis of indirect media presentations would have to have moved ahead. Given these two prerequisites, however, it might well become possible to predict at the preconstruction stage both how human observers, and even specific subgroups of observers, will most likely comprehend the environmental display and how the environmental display will be evaluated in terms of its success in fulfilling its function".³

As an architect I might add to encourage your efforts that every study along the way helps us to improve our predictions, or at least to be more modest about our intuition and to try earnestly to discover the characteristics of our users. But we need the more objective information which you can provide. Indeed, because the environmental psychologist has not been there when we needed him, many of our own rank have begun to do research in this area. I am a case in point.

³ Ibid. p. 36

PREVIOUS RESEARCH EFFORTS AND IMPLICATIONS

My research interests and previous efforts are remarkably akin to those set forth in the aforementioned article by Dr. Craik. I have concentrated my efforts to date on the comprehension or "meaning" of the architectural environment as opposed, say, to the directly observable behavior which it might evoke. My theoretical understanding of the chosen area is set forth in my dissertation: A Study of Meaning and Architecture⁴, and summarized in an article in the Journal of Aesthetic Education, entitled "Architecture and Meaning."⁵ The conceptual model of meaning postulated in these documents can be stated very briefly. Comprehension of the physical environment consists of two essential stages: (1) The first is the representational stage. The physical environment, serving as a stimulus object, is responded to in that it, and anything to which it refers as a sign, is represented in the human organism as a precept, concept, idea, image, or whatever. We "see" the rectangular object, "recognize" it to be a door, "feel" the coolness of the bronze knob, etc. (2) The second is the responsive stage. It consists of internal responses to the already internal representations. These responses might be affective, evaluative, or prescriptive in nature: "tinglings" in our spine, "feelings" of disgust or contempt, "thoughts" about the value of the represented environment, or "ideas" concerning what should be done about it. In any case this model of meaning, or comprehension, can be likened to an internalized stimulus-response situation where our representations of the architectural environment serve as stimuli for affective, evaluational, and prescriptive responses.

⁴ Robert C. Hershberger, A Study of Meaning and Architecture (Ann Arbor: University Microfilms, 1969).

⁵ _____, "Architecture and Meaning," Journal of Aesthetic Education, Vol. 4, No. 4 (October, 1970).

This conceptual understanding is of great importance to environmental psychology because, unlike the model advanced by Osgood et al.⁶, it states that where the environment is concerned there are two distinct aspects of comprehension and that the second is dependent on the first. If groups of people differ greatly in their representations of a specific architectural environment, there is little to be gained by comparing the responsive levels of meaning of the groups, because the responses will not be to the same stimulus! Some research, therefore, must be directed to what various groups represent in their architectural environments and why they differ. Other research must be directed to why affective, evaluational, and prescriptive differences occur when the representations are similar. Still other research must attack both ends and the middle at once to gain an understanding of why similar responses result from dissimilar representations. In any event we should know in which of the above three activities we are engaged.

My experimental work focused on the domain of the observer. In order to advance the cause of preconstruction prediction by architects, it seemed extremely important to determine if architects do, in fact, comprehend the architectural environment differently than laymen on either the representational or responsive levels of meaning and, if so, to discover to what this difference should be attributed. An experimental design was formulated, therefore, in which graduating architects at the University of Pennsylvania were compared with non-architects and pre-architects at the same institution

⁶ Charles E. Osgood, George J. Suci, and Percy H. Tannenbaum, The Measurement of Meaning (Urbana: University of Illinois Press, 1967).

relative to their comprehension of selected architectural environments. The pre-architects served as a control group whose comprehension, if similar to the non-architects and not the architects, would demonstrate the importance of the architectural education in influencing comprehension, or if similar to the architects and not the non-architects, would indicate that personality or pre-professional experience were of more importance. The methodology and results of this experiment are fully reported in the aforementioned dissertation and summarized in a paper given to the first annual Environmental Design Research Association Conference in Chapel Hill, North Carolina.⁷

Before the above experiment could be conducted it was necessary also to focus on the other three domains of research outlined by Dr. Craik:

(A) response formats, (B) media of presentation, and (C) environments.

Relative to the first it was decided to use the "semantic differential"

because it appeared to be a proven means by which representational and responsive levels of meaning could be studied. Thus, there was no manipulation of response formats in the study. There was, of course, the need to select an appropriate set of scales for architectural environments. The details of the selection procedure, which was logical rather than empirical, and comparisons with the work of several environmental psychologists are set forth in the dissertation.⁸

Relative to the second domain of research, the media of presentation, it was decided to use 35 mm. colored slides. This was a difficult decision because it seemed obvious that a slide could not fully represent a building. However, by utilizing buildings familiar to the respondents it was hoped that

⁷ Robert G. Hershberger, "A Study of Meaning and Architecture," EDRA I, proceedings of 1st Annual Environmental Design Research Assoc. Conf. (Raleigh, 1969).

⁸ _____, A Study of Meaning and Architecture, op. cit. pp. 87-91, 190-192.

the slides would evoke representations of the actual buildings and, thus, become an adequate substitute. In any event, since the same slides were being shown to all three respondent groups, it was held that the responses could serve as indices of the differing representations and responses that the various respondent groups would have had to the actual environments. The actual environments were not used because the time demand on respondents would have been unreasonable and the control over extraneous stimuli such as what the respondents actually saw, to whom they talked, the weather, etc. would have been most difficult and, hence, too expensive.

Relative to the third domain of research, the environments, it was necessary to select buildings presumed to be equally familiar to the respondents. Most were buildings on the campus of the University of Pennsylvania or in Center City Philadelphia. Buildings of the most noticeable differences in size, color, texture, composition, quality, permanence, use, etc. were chosen in an attempt to insure that the results of the experiment would not relate to just one type of building, but could be generalized to the architectural environment as a whole. By including an even number of slides of exteriors, entrances, and interiors it was possible to extend the above consideration of generalizability, but also to use the domain of environments as an experimental variable and to discover differences of meaning attributable to these specific building aspects.

All of the domains of research relating to the comprehension of the architectural environment outlined by Craik had to be thoroughly considered to get at my primary interests in the domain of observers - the differences between architects and laymen and the reasons behind the differences. Once established, the response format was held constant. The same was true for the media of presentation. So also were the environments. However,

stratification of aspect types did allow an interesting side area to be investigated.

The results of the experiment indicated that there were indeed pronounced differences between the Penn architects and non-architects in their comprehension of the architectural environments. Because the pre-architects were similar to the non-architects in nearly all comparisons, it was also evident that the architects' professional education had had a great deal to do with their different way of comprehending the architectural environment. If the results could be generalized to architectural education as a whole, the implications would bid ill for the architect's predictive powers. The architect might be the worst person around to predict how laymen, the users of his buildings, will represent and respond to what he creates. Furthermore, because the groups compared at Penn were very similar in almost every other respect - ethnically, educationally, geographically, agewise, economically, etc. - one can only wonder about the vast differences which might pertain when these other areas become variables.

RESULTS OF RECENT RESEARCH

My research has continued towards the end of improving the architect's ability to make pre-construction predictions by (1) making further comparisons of the environmental comprehension of different groups of people, and by (2) considering problems relating to the adequacy of various media to represent the architectural environment. Relative to the first, the recent study was simple. A representative sample consisting of twelve of the original group of twenty-five colored slides was presented to a group of seventy-six pre-architects at Arizona State University. They rated them on the same set of "semantic differential" scales and under very similar

circumstances to those which had applied at Pennsylvania.⁹ The objective of this phase of the research was to determine if major geographical (and hence cultural?) differences could account for as many significant differences in the comprehension of the architectural environment as had the architects' education in the previous study.

PENN vs. A.S.U.

As had been the procedure at Penn, the Arizona State University pre-architects were first compared with the University of Pennsylvania pre-architects using factor analysis.¹⁰ The purpose of this comparison was to determine if the same factors or dimensions of meaning which had occurred for the pre-architects at Penn would occur for the pre-architects at Arizona State. The results of these analyses can be seen on TABLE A on the following page. For both analyses the factors extracted were similar for the Penn and the A.S.U. pre-architects. The primary difference on the first factor analysis (three factors) was that scales indicating novelty and affect, such as profound-superficial, unique-common, active-passive,

⁹ It was recognized that unequal familiarity with the buildings would confound interpretation of the results. The fact that only twelve (rather than twenty-four) building aspects were used in this study might also tend to confound interpretation of the results of the factor analyses.

¹⁰ Factor analysis was by the principal factor method using the Pearson product-moment correlation matrices as input. The diagonal elements, initially the squared multiple correlations, were iterated by refactoring until the maximum change in communality estimates was less than .001. The factors were kept orthogonal to yield Varimax rotations. For the first series of analyses the minimum eigenvalue was unity. This value determined both the number of principal components and the number of rotations. For the second series of analyses extraction and rotation of five factors was required. Both series of analyses were performed utilizing the BMD 03M program on the CDC 6400 computer at the Arizona State University Computer Center.

TABLE A

VARIMAX FACTOR LOADINGS OVER .40, BY FACTORS OVER
PENN PRE-ARCHITECTS AND 25 BUILDINGS AND A.S.U. PRE-
ARCHITECTS AND 13 BUILDINGS USING COLORED SLIDES

PENN PRE-ARCHITECTS				A.S.U. PRE-ARCHITECTS			
3 Factors (52% total)		5 Factors (57% total)		3 Factors (50% total)		5 Factors (53% total)	
I Eval. (space)		I Eval. (space)		I Eval. (space)		I Eval. (space)	
** cheerful	.82	** welcoming	.78	** delightful	.88	** delightful	.85
** delightful	.82	** pleasing	.76	** cheerful	.86	** pleasing	.84
** pleasing	.79	** delightful	.76	** pleasing	.86	** welcoming	.82
** good	.77	** cheerful	.74	** welcoming	.84	** cheerful	.81
** welcoming	.76	** beautiful	.72	** beautiful	.81	** comfortable	.79
** beautiful	.75	** good	.69	** good	.79	** beautiful	.78
open	.69	** comfortable	.69	** comfortable	.77	** good	.74
spacious	.66	open	.58*	open	.70	loose	.61
interesting	.67	spacious	.57	loose	.67	open	.61
** comfortable	.63	interesting	.54*	interesting	.67	spacious	.59
loose	.58	loose	.44	spacious	.66	interesting	.57*
revolutionary	.56			delicate	.46	delicate (r)	.43*
exciting	.52			exciting	.44*		
unique	.50			active	.42*		
active	.42			unique	.40*		
II Organization		II Organization		II Organization (affect)		II Organization	
** ordered	.85	** ordered	.81	** ordered	.71	** ordered	.67
** clear	.69	** simple	.71	** simple	.70	** clear	.64
** simple	.69	** straightfwd	.68	** clear	.65	** straightfwd	.62
** straightfwd	.68	** clear	.68	passive	.61	** simple	.59
** controlled	.67	plain	.65	calming	.57	** rational	.53
** rational	.65	** controlled	.64	** straightfwd	.56	** controlled	.52
considered	.58	** rational	.62	** rational	.56	plain	.47
continuous	.57	considered	.57	common	.53	considered	.46
plain	.55	continuous	.57	plain	.49	continuous	.42
				** controlled	.40	passive (a)	.41*
III Potency (Activity)		III Potency		III Potency		III Potency	
** strong	.69	** permanent	.69	** strong	.71	** strong	.69
** bold	.67	** strong	.63	** bold	.68	** bold	.65
** permanent	.57	** rugged	.54	** permanent	.60	** permanent	.64
profound	.54	** bold	.50*	** rugged	.50	** rugged (d)	.52
** rugged	.49	profound	.43				
active	.48						
unique	.48*						
interesting	.48*						
exciting	.46*						
IV Space		IV Space		IV Space		IV Space	
		** open	.59			** open	.53*
		** spacious	.56*			** spacious	.51*
V Aesthetic		V Aesthetic		V Aesthetic		V Aesthetic	
		** unique	.71			** unique	.67
		** exciting	.68			** interesting	.59
		** revolutionary	.61			** exciting	.59
		** active	.55			** active (p)	.51
		bold	.52			** revolutionary	.50
		** interesting	.62			specific	.42
		good	.47*				
		delightful	.40*				

* These scales load more highly on one of the other factors.

() Parentheses indicate that loadings on the opposite pole of the scale are indicated under another factor.

** These scales were used to compute factor scores for all groups.

interesting-boring, and exciting-calming which had loaded positively on the potency dimension for the Penn pre-architects switched over and loaded negatively on the organization dimension for the A.S.U. pre-architects. In both cases these scales also had positive loadings on the evaluation dimensions as did the space scales such as open-closed, spacious-confined, and loose-tight. When five factors were required the novelty-affective scales formed a relatively strong and independent "aesthetic" dimension for both groups. The space scales, on the other hand, formed only very weak and secondary dimensions for both groups.

The implications of the above are important. First, because both groups used essentially the same dimensions of meaning, there is evidence that a "common frame of reference" exists with respect to architectural subject material even for subject groups widely separated geographically. The same was found in the earlier study between the educationally separated groups at Pennsylvania.¹¹ This result lends hope to the effort by a number of environmental psychologists to find a small set of dimensions which would account for the entire field of architectural meaning or comprehension. Second, because the aesthetic dimension was clearly related to the potency of the architectural subject material for the Penn pre-architects, but related to the lack of organization for the A.S.U. pre-architects, there was evidence of considerable geographical variation on the affective and evaluative dimensions of meaning as they relate to the representational dimensions.

The A.S.U. pre-architects were also compared with the Penn pre-architects relative to differences in their judgements of meaning on each of

¹¹ This could, of course, be an artifact of the scales used. Even so, it indicates that a good deal of commonality exists between the various respondent groups in their use of language relative to architecture.

the twelve building aspects. The basic procedure here was to use one-way analysis of variance to compare the factor scores of the two respondent groups on each building aspect.¹² This was an important phase of the analyses, because respondent groups which use the same dimensions of meaning might, nevertheless, be quite different in their judgements of meaning for specific buildings. The results of this comparison are summarized on TABLE B on the following page. There were a total of twenty-eight significant differences, seven in opposite directions, for the sixty comparisons on the five factors over the twelve buildings. In other words, nearly half of the judgements on the principal dimensions of meaning were different at the .05 or higher levels of significance. Of interest is the fact that the significant differences were distributed rather equally over the five factors and twelve building aspects, which might indicate rather general differences in the representational and responsive levels of meaning of the two groups, rather than strong differences on a particular dimension or building aspect.

The only area in which the comparison indicated important differences between the two groups was on the space dimension. On this dimension there were six significant differences of a possible twelve, and three were in opposite directions. In addition, on all six of the significant differences the Penn pre-architects attributed a greater amount of spaciousness to the buildings than did the A.S.U. pre-architects. Furthermore, all but one of the significant differences on this dimension, and all which were in opposite directions, were not on slides showing views of interior spaces. The results, thus, are highly suggestive that a person who has actually

¹² Factor scores were computed utilizing the scales noted by double asterisks on Table A for each of the five factors utilizing a program developed by the author for summing across individual respondents and dividing by the number of scales summed.

TABLE B

SIGNIFICANT DIFFERENCES BETWEEN RESPONDENT
GROUPS OVER 12 BUILDINGS AND ALL FACTORS

PENN PRE-ARCHITECTS vs. ASU PRE-ARCHITECTS

		Evaluation	Organization	Potency	Space	Aesthetic	TOTAL
1 Phila Museum	(E)	(**)P		***A	(*)P		3 (2)
2 Police Bldg.	(X)		***P	*P			2
3 TNA Terminal	(I)	*A					1
4 House of Doors	(X)	**A					1
5 Logan Hall	(E)			***A		***A	2
6 Amer. Pavilion	(I)	**A	*A				2
7 Subway Station	(E)	***P	***P	*P	**P		4
8 Habitat	(X)	(**)P			(***)P		2 (2)
9 Richards Bldg.	(X)	***P			(***)P	(***)P	3 (2)
10 Annenberg Sch.	(I)				*P	*	2
11 Munic. Services	(X)		*P				1
12 Hill Hall	(E)	***P	*A	***A	***P	(***)P	5 (1)
		8 (2)	5	5	6 (3)	4 (2)	28 (7)
							60

Levels of Significance

* = .05

** = .01

*** = .001

() means judgement in opposite direction

A = Arizona State judgements more positive

P = University of Pennsylvania more positive

(E) = entrance

(X) = exterior

(I) = interior

experienced a building will judge even its exterior and entrance on the basis of what he knows about its interior. All of the entrances and exteriors judged significantly more spacious by the Penn pre-architects, with the possible exception of the Richards Building, were known by most of the Penn pre-architects to possess rather major interior spaces behind their apparently non-too-spacious exteriors.

An overall comparison between all of the respondent groups on the previous study at Penn and the current study at A.S.U. is also of interest. Comparing them by pairs relative to significant differences over the five factors and the twelve building aspects, the results were as follows:

Table C.

SIGNIFICANT DIFFERENCES BETWEEN RESPONDENT GROUPS

Penn pre-architect vs. A.S.U. pre-architect	= 28
Penn architect vs. Penn non-architect	= 28
Penn architect vs. Penn pre-architect	= 16
Penn pre-architect vs. Penn non-architect	= 14

The obvious implication of the above is that geographical separation of otherwise similar groups (pre-architects) makes as much difference relative to specific judgements on building aspects as does differing educational focus of otherwise similar groups (students at Penn). Caution must be exercised here, however, because of the differences in familiarity with the buildings, already pointed out relative to the space dimension, which might have accounted for some of the differences on other dimensions as well. This was especially shown to be the case with the evaluational dimension which had been shown previously by the factor analytic studies to be closely

related to the space dimension for both groups of pre-architects. For example, all six of the building aspects seen to be more spacious by the Penn architects were also judged more positively by them on the evaluation dimension, five at a significant level, and two of the five actually in opposite directions from the judgement of the A.S.U. pre-architects. It is possible, therefore, that nearly all of the significant differences between judgements on the space and evaluation dimensions could be accounted for by the differential familiarity with the chosen buildings. Only with further experimentation directed at this particular problem could actual causal relations be inferred.

COLORED SLIDES vs. BLACK AND WHITE SLIDES

The second aspect of the recent study involved comparisons of two randomly divided groups of pre-architects at A.S.U. over the same building aspects and scales used in the above comparison. Indeed, the set of data based on colored slides was that of the pre-architect group used in the above comparison. The other group of seventy-five A.S.U. pre-architects made their judgements on black and white slide reproductions of the original colored slides. These were of a somewhat reduced quality from the original slides owing to the process of reproduction. However, because this is generally the case for classroom use of black and white slides which most often are taken from plates in books, it was believed that the comparison might still be useful. Further, since this was to be a pilot study for a more comprehensive comparison of presentation media, it was believed that areas of difference might nevertheless be detected which would be invaluable for the design of subsequent research.

The statistical analyses performed on the data obtained from the two respondent groups relative to colored and black and white slides were

identical to those performed for the first part of the study. Factor analysis was used to compare the basic dimensionality of meaning extracted from the two media types. Analysis of variance was used to compare the judgements on specific factors and scales over all thirteen of the building aspects used in this comparison. The results of the factor analytic comparisons are shown in TABLE D on the following page. Here again the same three factors emerged when the eigenvalues were kept over unity. Similar to the previous comparisons, the affective and novelty scales appeared to account for most factor differences. For the black and white slides these scales now loaded positively and exclusively on the evaluative (space) dimension, unlike the colored slides where they loaded negatively on the organization dimension, unlike the Penn pre-architects where they loaded positively on the potency dimension. The forced extraction and rotation of five factors in the subsequent analyses further demonstrated the strong affiliation of these scales with the evaluation (space) dimension and only weak secondary loadings were associated with an apparently spurious complexity/activity dimension. The space scales also remained more strongly related to the evaluative dimension than for any of the groups which had responded to colored slides, to leave only an extremely weak and secondary space dimension. Thus, for black and white slides, admittedly of inferior quality, it appears that it was not possible for the respondents to identify the aesthetic qualities of the architectural subject material independently from its perceived spatial qualities or how it was evaluated. A relatively strong and independent aesthetic dimension simply did not appear as it had in all previous studies utilizing colored slides as the media of presentation. If this resulted from the fact that the slides were black and white, and not because of their inferior quality, it is a truly remarkable finding for it suggests that if aesthetic appreciation is desired - don't use black and white slides for

TABLE D
VARIMAX FACTOR LOADINGS OVER .40, BY FACTORS OVER
MEDIA TYPES AND 13 BUILDINGS
(ARIZONA STATE UNIVERSITY PRE-ARCHITECTS AS RESPONDENTS)

BLACK AND WHITE SLIDES				COLORED SLIDES			
3 Factors (51% total)		5 Factors (55% total)		3 Factors (50% total)		5 Factors (53% total)	
I Eval. (space/affect)		I Eval. (space/affect)		I Eval. (space)		I Eval. (space)	
** delightful	.90	** delightful	.90	** delightful	.88	** delightful	.85
** pleasing	.88	** pleasing	.88	** cheerful	.86	** pleasing	.84
** cheerful	.87	** cheerful	.85	** pleasing	.86	** welcoming	.82
** good	.83	** good	.83	** welcoming	.84	** cheerful	.81
** welcoming	.82	** welcoming	.81	** beautiful	.81	** comfortable	.79
** beautiful	.81	** beautiful	.81	** good	.79	** beautiful	.78
interesting	.78	** comfortable	.79	** comfortable	.77	** good	.74
** comfortable	.78	interesting	.75	open	.70	** loose	.61
open	.73	open	.67	loose	.67	open	.61
spacious	.70	spacious	.65	interesting	.67	spacious	.59
exciting	.63	loose	.60	spacious	.66	interesting	.57*
loose	.62	exciting	.56	delicate	.46	delicate (r)	.43*
active	.59	active	.52	exciting	.44*		
unique (c)	.54	unique	.50	active	.42*		
revolutionary	.46	revolutionary	.47	unique	.40*		
delicate (r)	.42						
II Organization		II Organization		II Organization (affect)		II Organization	
** ordered	.70	** ordered	.70	** ordered	.71	** ordered	.67
** clear	.66	** controlled	.67	** simple	.70	** clear	.64
** straightfwd	.64	** straightfwd	.56	** clear	.65	** straightfwd	.62
** simple	.59	considered	.52	passive	.61	** simple	.59
** rational	.52	** clear (a)	.51	calming	.57	** rational	.53
** controlled	.52	** rational	.48	** straightfwd	.56	** controlled	.52
continuous	.46	continuous	.44	** rational	.56	plain	.47
common (u)	.41*			common	.53	considered	.46
considered	.41			plain	.49	continuous	.42
				** controlled	.40	passive (a)	.41*
III Potency		III Potency		III Potency		III Potency	
** strong	.72	** strong	.72	** strong	.71	** strong	.69
** bold	.70	** bold	.67	** bold	.68	** bold	.65
** permanent	.61	** rugged	.65	** permanent	.60	** permanent	.64
** rugged (d)	.58	** permanent	.62	** rugged	.50	** rugged (d)	.52
		IV Space				IV Space	
		** spacious	.45*			** open	.53*
		** open	.43*			** spacious	.51*
		V Complex/active				V Aesthetic	
		complex	.66			** unique	.67
		ornate	.58			** interesting	.59
		exciting	.51*			** exciting	.59
		active	.46*			** active (p)	.51
		unique	.44*			** revolutionary	.50
		ambiguous (c)	.42*			specific	.42

* These scales load more highly on one of the other factors.

() Parentheses indicate that loadings on the opposite pole of the scale are indicated under another factor.

** These scales were used to compute factor scores for all groups.

architectural environments or your judgements are likely to be confounded with the felt spaciousness of the environment and positive evaluations of such as its comfort, pleasantness, cheerfulness, and goodness. However, if the findings related to the quality of the slides, they might reflect quite adversely on such media as television where low quality of the image is standard for both black and white and colored images.

The comparisons utilizing analysis of variance for the several factors also produced some interesting results. These are shown on TABLE E on the following page. First of all it was not possible to make comparisons on an aesthetic dimension since no such dimension had appeared for the black and white slides. The comparison of the remaining four factors was, however, revealing in that only eleven significant differences occurred over fifty-two comparisons, and only three of these were in opposite directions. Again, no particular factor(s) tended to account for most of the differences. The differences between media types, therefore, appeared to make little difference on these dimensions. However two building aspects, the exterior of the Police Building and the interior of Hill Hall, together accounted for six of the eleven differences. Because the Police Building was practically black and white even in the colored slides and the interior of Hill Hall was a bright red, it is hard to account for these differences with a single explanation. The second clearly related to the color, which was not at all obvious on the black and white reproductions. The first apparently related to an unusually poor reproduction.

Because an aesthetic dimension did not appear for the black and white slides, it was decided to run an analysis of variance on each of the scales ordinarily loading highly on this dimension in an attempt to discover why it had not appeared for the black and white slides. The results are shown

TABLE E
SIGNIFICANT DIFFERENCES BETWEEN MEDIA TYPES
OVER 13 BUILDINGS AND 4 FACTORS

BLACK & WHITE SLIDES vs. COLORED SLIDES

		Evaluation	Organization	Potency	Space	TOTAL
1	Phila Museum	(E)				0
2	Police Bldg.	(X) ***C	***B		(**)C	3 (1)
3	TWA Terminal	(I)				0
4	House of Doors	(X)				0
5	Logan Hall	(E)				0
6	Amer. Pavilion	(I) **C		(**)C		2 (1)
7	Subway Station	(E)				0
8	Habitat	(X)				0
9	Richards Bldg.	(X)		**B		1
10	Annenberg Sch.	(I)	*C			1
11	Munic. Services	(X) **C				1
12	Hill Hall	(E)				0
13	Hill Hall	(I) (***)C	*B		**C	3 (1)
		4 (1)	3	2 (1)	2 (1)	11 (3)

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Levels of Significance

- * = .05
- ** = .01
- *** = .001
- () means judgement in opposite direction
- C = colored slide judgements more positive
- B = black and white slide judgements more positive
- (E) = entrance
- (X) = exterior
- (I) = interior

on TABLE F on the following page. Here we find a higher number of significant differences, twenty-four of a possible sixty-four (over one-third) and four in opposite directions. Here again the differences are distributed about equally over the scales with the two earlier mentioned building aspects accounting for ten of the twenty-four significant differences. The direction of the differences is also revealing. Twenty of the twenty-four significant differences were more towards the positive end of the scales for the colored slides. Coupled with the fact that four of four significant differences on the evaluation dimension and two of two on the space dimension were also more positive for the colored slides, see TABLE E, there is a strong indication that either the color or the quality of slides has a great deal to do with positive judgements of what they represent. Conversely, the lack of color or quality apparently assures more negative evaluations, particularly on the aesthetic areas of meaning.

What then are the implications of the above study relative to preconstruction predictions by architects. First, it would appear that geographical separation of the architect from his user might very well result in differing aesthetic responses to what he designs. For example, a pre-architect from the University of Pennsylvania might design a strong, rugged, and permanent building, which was also highly ordered, clear, and straightforward, for the pre-architect at Arizona State University because he thought the A.S.U. student would find it unique, interesting, and even exciting, just as he had. But instead most of the students at A.S.U. would find it to be rather common, boring, and calming. The Penn student would be responding aesthetically to the building's perceived potency while the A.S.U. student would be responding aesthetically to its perceived organization. Second, the familiarity with a building is likely to influence one's reactions to it, especially relative to

TABLE F
SIGNIFICANT DIFFERENCES BETWEEN MEDIA
TYPES OVER 13 BUILDINGS AND 5 SCALES

Black and White Slides vs. Colored Slides

	Unique	Interesting	Exciting	Active	Revolut	TOTAL
1 Phila Museum	(E)			*C	*C	2
2 Police Bldg.	(X) ***C	***C	***C	***B	***B	5
3 TWA Terminal	(I)					0
4 House of Doors	(X)					0
5 Logan Hall	(E)	(**)C	**C			2 (1)
6 Amer. Pavilion	(I)	*C	*C	**B		3
7 Subway Station	(E)			**C		1
8 Habitat	(X)					0
9 Richards Bldg.	(X) *C	(*)C	*C			3 (1)
10 Annenberg Sch.	(I)			(***)C	*B	2 (1)
11 Municipal Serv.	(X)	*C				1
12 Hill Hall	(E)					0
13 Hill Hall	(I) ***C	(***)C	***C	***B	*C	5 (1)
	3	6 (3)	5	6 (1)	4	24 (4)

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Levels of Significance

- * = .05
- ** = .01
- *** = .001
- () means judgement in opposite direction
- C = colored slide judgements more positive
- B = black and white slide judgements more positive
- (E) = entrance
- (X) = exterior
- (I) = interior

its spaciousness. If an architect designed a very solid looking building with few exterior openings but truly grand interior spaces, he might attribute more spaciousness to the facade, or a representation of it, than would a passer-by who had never experienced its interior. Third, high quality colored slides appear more likely to elicit a relatively strong and independent aesthetic dimension of meaning than do low quality black and white slides. Whether the color quality, or their combination, account for the differences was not established by the study. However, since architects are interested in making pre-construction predictions about the aesthetic qualities of their buildings, it would be well for environmental psychologists to employ media which tend to evoke such responses. Fourth, it was not established by the study whether or not the aesthetic responses on either of the media are accurate indicators of responses to actual environments. It was only demonstrated that aesthetic judgements would tend to be more positive for high quality colored slides, and this finding, and the occurrence of the so-called "aesthetic" dimension, might simply be in response to the aesthetic quality of the slides and not to the imagined aesthetic qualities of the buildings they were intended to represent. Consequently, additional research comparing aesthetic responses to actual environments with similar responses to a variety of representational media will be required before any conclusions should be reached relative to the media which might best substitute for experience of actual environments. Until this is accomplished the architect who wants to predict the aesthetic responses of users to his buildings should pay little heed to environmental psychologists who use representational media of any kind with the untested assumption that the responses obtained are adequate substitutes for responses to the actual environments. The results are as likely to mislead as to help the architect with his preconstruction

predictions. The same should be said for all other dimensions of the comprehension of the architectural environment.

CURRENT RESEARCH

I am currently conducting an experimental study aimed precisely at the above cautionary remarks because substitute media must be found if we are ever to obtain the vast amount of information necessary to make consistently accurate preconstruction predictions about the comprehension of the physical environment. Briefly, I am comparing responses on a similar set of semantic differential scales over a variety of housing types for six respondent groups randomly selected from the same population. One group will respond to the actual environments. The others will respond to a variety of presentational media commonly used in studies of environmental comprehension. The media types are as follows: (1) single colored slides, (2) colored slide sequences, (3) colored film sequences, (4) black and white video tape sequences, (5) colored slides with audio interpretations. Hopefully, this research and the other research being presented in the symposium today will lead to the discovery of media or combinations of media which will, in fact, elicit valid and accurate information about the ways in which various respondent groups comprehend their architectural environments and, hence, lead the way to the time when architects will be able to predict the comprehension of environments they create with consistent accuracy. Help us to hasten the day.